Plant Assessment Form

For use with the "Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands" by the California Exotic Pest Plant Council and the Southwest Vegetation Management Association (Warner et al. 2003)

Printable version, February 28, 2003
(Modified for use in Arizona, 07/02/04)

Table 1. Species and Evaluator Information

Species name (Latin binomial)**:**	*Eichhornia crassipes* (Mart.) Solms (USDA 2005)
Synonyms:	*Eichhornia speciosa* Kunth, *Piaropus crassipes* (Mart.) Raf. (USDA 2005)
Common names:	Water hyacinth, common water hyacinth, floating water hyacinth
Evaluation date (mm/dd/yy)**:**	02/16/04
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Committee review date:	03/26/04 and 05/21/04
List date:	05/21/04
Re-evaluation date(s):	

Table 2. Scores, Designations, and Documentation Levels

Question		Score	Documentation Level	Section Scores	Overall Score & Designations
1.1	Impact on abiotic ecosystem processes	**A**	Other published material	**"Impact"** **Section 1 Score:** **A**	**"Plant Score"** **Overall Score:** **High** **Alert Status:** **Alert**
1.2	Impact on plant community	**A**	Observational		
1.3	Impact on higher trophic levels	**A**	Observational		
1.4	Impact on genetic integrity	**D**	Other published material		
2.1	Role of anthropogenic and natural disturbance	**A**	Other published material	**"Invasiveness"** *For questions at left, an A gets 3 points, a B gets 2, a C gets 1, and a D or U gets=0. Sum total of all points for Q2.1-2.7:* **11 pts** **Section 2 Score:** **B**	
2.2	Local rate of spread with no management	**U**	Observational		
2.3	Recent trend in total area infested within state	**C**	Observational		
2.4	Innate reproductive potential	**A**	Other published material		
2.5	Potential for human-caused dispersal	**B**	Observational		
2.6	Potential for natural long-distance dispersal	**C**	Observational		
2.7	Other regions invaded	**C**	Observational		RED FLAG **YES** Something you should know.
3.1	Ecological amplitude	**D**	Observational	**"Distribution"** **Section 3 Score:** **D**	
3.2	Distribution	**U**	Observational		

Red Flag Annotation

At present no wildland aquatic ecosystems within Arizona are known to be infested with *Eichhornia crassipes*. Records at the Arizona Department of Agriculture, however, indicate several small (<0.4 hectares [1 acre]) populations have been discovered and eradicated from Arizona wildland streams, park

ponds, and irrigation tail-water pits during the past 20 years. *Eichhornia crassipes* is listed as a regulated and restricted noxious weed in Arizona.

Table 3. Documentation

Question 1.1 Impact on abiotic ecosystem processes *Score:* **A** *Doc'n Level:* **Other pub.**
Identify ecosystem processes impacted: No wildland aquatic ecosystems within Arizona are known to be infested with *Eichhornia crassipes* at this time (ADA Undated a; F. Northam, personal observations, 2004). Records at the Arizona Department of Agriculture, Noxious Weed Program Office, however, show several small (<1 acre) populations have been discovered and eliminated in Arizona streams, park ponds, and irrigation tail water pits during the past 20 years (ADA Undated b). Wastewater reclamation wetlands at Sahuarita High School and Arizona Desert Museum in Pima County maintain treatment ponds, which use *E. crassipes* as filter plants. Dense populations of this species produce thick mats that lower dissolved oxygen and pH, increase carbon dioxide, restrict water flow, and reduce sunlight to submerged species.
Rationale: In Arizona rapid vegetative growth will be the biological attribute by which *E. crassipes* will degrade natural ecosystem processes if this species escapes into permanent water bodies. The Working Group assumed the same water quality factors will be damaged in susceptible Arizona waters, as has been described in other North American regions and other continents. Rapid growth during summer creates a management problem requiring wasterwater reclamation populations to be periodically thinned (Holm et al. 1991, Parsons and Cuthbertson 1992, Godfrey 2000). One acre of *E. crassipes* mat can weight up to 200 tons; this further degrades water quality by reducing dissolved oxygen when large numbers of plants die and decompose (Ramey 2001). Evapotranspiration by dense colonies of *E. crassipes* is up to four times higher than from open non-infested water surfaces (DNRM 2005).
Sources of information: See cited literature. Also considered Arizona weed location records documented by F. Northam (Weed Biologist, Tempe, Arizona, 2004).

Question 1.2 Impact on plant community composition, structure, and interactions *Score:* **A** *Doc'n Level:* **Obs.**
Identify type of impact or alteration: As stated in question 1.1, aggressive rapid growth of *E. crassipes* is the competitive mechanism by which native aquatic Arizona plants will be physically displaced and normal sunlight penetration to submerged plants will be blocked. Equally aggressive growth by submerged *E. crassipes* roots will make inorganic nutrients less available for native aquatic plants.
Rationale: Reports of *E. crassipes* attributes from other regions are the basis of predictions of ecological damage to native Arizona aquatic plant communities by this introduced pest.
Sources of information: See sources cited in question 1.1.

Question 1.3 Impact on higher trophic levels *Score:* **A** *Doc'n Level:* **Obs.**
Identify type of impact or alteration: No information is available that documents *E. crassipes* effects on higher trophic organisms in Arizona; however, reports from other states and regions indicate Arizona aquatic habitats should be expected to have drastic reductions in organisms that use native aquatic plants for forage, breeding sites, escape areas, etc. if *E. crassipes* were to become established over large areas of Arizona surface waters (see references in questions 1.1 and 1.2.). *Eichhornia crassipes* also increases mosquito habitat, which can increase the potential for mosquito-borne diseases.
Rationale: See discussions in questions 1.1 and 1.2 concerning reduction of sunlight to submerged plants and elimination of dissolved oxygen for aerobic organisms due to decomposition of water hyacinth biomass. *Eichhornia crassipes* growth can produce dense mats that provide habitat for mosquitos. As this mosquito habitat increases, it becomes potential breeding sites for vectors of

arthropod-borne diseases such as West Nile virus, malaria, and encephalitis (USGS 2001, DNRM 2005, Center for Disease Control Undated, Florida Department of Environmental Protection Undated).
Sources of information: See cited literature and other references cited in question 1.1. Also considered information from the Florida Department of Environmental Protection, Bureau of Invasive Plant Management. Undated. Weed Alert: Water-hyacinth (*Eichhornia crassipes*) (available online at: http://www.dep.state.fl.us/lands/invaspec/2ndlevpgs/pdfs/hyacinth.pdf; accessed March 2004) and Center for Disease Control, Division of Vector-Borne Infectious Diseases. Undated. Arboviral Encephalitides (available online at: http://www.cdc.gov/ncidod/dvbid/arbor/indes.htm; accessed March 2004).

Question 1.4 Impact on genetic integrity *Score:* **D** *Doc'n Level:* **Other pub.**
Identify impacts: None reported for Arizona.
Rationale: No native *Eichhornia* species occur in Arizona (Kearney and Peebles 1960).
Sources of information: See cited literature. See also USDA (2005).

Question 2.1 Role of anthropogenic and natural disturbance in establishment *Score:* **A** *Doc'n Level:* **Other pub.**
Describe role of disturbance: Habitat disturbance is not required for an aquatic environment to become infested with *E. crassipes.* Observations and enforcement activities by Arizona Department of Agriculture inspectors show that *E. crassipes* is produced and traded by water garden hobbyists in central, south-central, and southwestern Arizona.
Rationale: As an obligate aquatic macrophyte, *E. crassipes* cannot survive extended periods out of water. Likewise, because of its tropical origin, this plant does not survive in regions where surface waters freeze far enough below the surface to kill plant crowns (rhizomes; Holm et al. 1991, Ramey 2001). As a result, dispersal to new watersheds in Arizona is a direct result of human transport from one water body to another and does not require disturbance for establishment. Anywhere humans can dump *E. crassipes* in natural waters and where annual temperatures are mild, this species will establish regardless of the ecological state of the site. Observations of *E. crassipes* growth and reproduction in commercial ponds and constructed wetlands in Arizona suggest that this species will thrive and dominate natural aquatic ecosystems where current water velocity is none or slight (ADA Undated a; F. Northam, personal observations, 2003, 2004). Field observations and enforcement activities by Arizona Department of Agriculture inspectors show that *E. crassipes* is produced and traded by water garden hobbyists in central, south-central, and southwestern Arizona (ADA Undated a). Acceptable climates for *E. crassipes* survival in Arizona wildlands occur below 2500 feet elevation. Once established, vegetative reproduction during June to October provides new plants for further infestations downstream. During cool-weather months (November through May), plants become dormant above water. In Arizona at elevations above 3000 feet, *E. crassipes* plants are killed by winter climate conditions (F. Northam, personal observations, 2003).
Sources of information: See cited literature. Also considered personal observations by F. Northam (during tenure as the Arizona Noxious Weed Program Coordinator, Arizona Department of Agriculture, Phoenix, Arizona, 2003) and Arizona weed location records documented by F. Northam (Weed Biologist, Tempe, Arizona, 2004).

Question 2.2 Local rate of spread with no management *Score:* **U** *Doc'n Level:* **Obs.**
Describe rate of spread: Stable
Rationale: No known infestations in natural freshwater habitats in Arizona.

Sources of information: See ADA (Undated a). Also considered personal observations by F. Northam (during tenure as the Arizona Noxious Weed Program Coordinator, Arizona Department of Agriculture, Phoenix, Arizona, 2003) and Arizona weed location records documented by F. Northam (Weed Biologist, Tempe, Arizona, 2004).

Question 2.3 Recent trend in total area infested within state *Score:* **C** *Doc'n Level:* **Obs.**
Describe trend: Stable
Rationale: No reports of recent increase or decrease of total area infested in Arizona (ADA Undated a; F. Northam, personal observations, 2003, 2004).
Sources of information: See cited literature. Also considered personal observations by F. Northam (during tenure as the Arizona Noxious Weed Program Coordinator, Arizona Department of Agriculture, Phoenix, Arizona, 2003) and Arizona weed location records documented by F. Northam (Weed Biologist, Tempe, Arizona, 2004).

Question 2.4 Innate reproductive potential *Score:* **A** *Doc'n Level:* **Other pub.**
Describe key reproductive characteristics: Matures in<1 year, produces seed every year, produces seed at least 3 months per year, rapid vegetative reproduction, fragments easily and can establish elsewhere, and resprouts when cut.
Rationale: Seed production occurs, but seed and seedlings are rarely seen in wildland infestations (Batcher 2000). Descriptions of *E. crassipes* growth and reproduction in California and Florida indicate this weed is an economic and ecological threat to Arizona waters because of its rapid vegetative reproduction (Holm et al. 1991, Godfrey 2000, Ramey 2001).
Sources of information: See cited literature.

Question 2.5 Potential for human-caused dispersal *Score:* **B** *Doc'n Level:* **Obs.**
Identify dispersal mechanisms: Deliberate introduction into public waters, transport on boats and trailers, commercial sales, and aquarium hobbyists.
Rationale: Deliberate introduction of vegetative material into public waters, transport on boats and trailers, and commercial sales contribute to a high probability of human introduction into aquatic wildland habitats (Godfrey 2000). Anywhere humans can dump *E. crassipes* into natural waters and where annual temperatures are mild, this species will establish regardless of the ecological state of the site (F. Northam, personal observation, 2004).
Sources of information: See cited literature. Also considered Arizona weed location records documented by F. Northam (Weed Biologist, Tempe, Arizona, 2004).

Question 2.6 Potential for natural long-distance dispersal *Score:* **C** *Doc'n Level:* **Obs.**
Identify dispersal mechanisms: Flood dispersal can move *E. crassipes* many kilometers downstream, but this species cannot migrate upstream without human intervention.
Rationale: At this time, no known infestations occur in natural freshwater habitats in Arizona. As a result, dispersal by natural agents is unlikely (ADA Undated a; F. Northam, personal observations, 2003, 2004). Underwater seed dissemination and scarcity of seedlings suggest long distance dispersal from horticultural sites by wind, mammals, birds, etc. is unlikely (Batcher 2000).
Sources of information: See cited literature. Also considered personal observations by F. Northam (during tenure as the Arizona Noxious Weed Program Coordinator, Arizona Department of Agriculture, Phoenix, Arizona, 2003) and Arizona weed location records documented by F. Northam (Weed Biologist, Tempe, Arizona, 2004).

Question 2.7 Other regions invaded	*Score:* **C** *Doc'n Level:* **Obs.**
Identify other regions: Invades similar ecological types in other states with appropriate warm temperatures during winter: streams, channels and lakes. *Eichhornia crassipes* invades elsewhere, but only in ecological types that are similar to where it will or has survived in Arizona (F. Northam, personal observation, 2004).	
Rationale: *Eichhornia crassipes* is restricted to freshwater habitats that rarely freeze (Holm et al. 1991, Parsons and Cuthbertson 1992, Godfrey 2000).	
Sources of information: See cited literature. Also considered Arizona weed location records documented by F. Northam (Weed Biologist, Tempe, Arizona, 2004).	

Question 3.1 Ecological amplitude	*Score:* **D** *Doc'n Level:* **Obs.**
Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: Historically it was present in Arizona streams but has since been eradicated. Acceptable climates for *E. crassipes* survival in Arizona wildlands occur below 2500 feet elevation. Once established, vegetative reproduction during June to October provides new plants for further infestations downstream.	
Rationale: Freshwater systems with little or no current are the only ecological types where *E. crassipes* will colonize in Arizona wildlands (F. Northam, personal observation, 2004). See Worksheet B.	
Sources of information: See ADA (Undated a). Also considered Arizona weed location records documented by F. Northam (Weed Biologist, Tempe, Arizona, 2004).	

Question 3.2 Distribution	*Score:* **U** *Doc'n Level:* **Obs.**
Describe distribution: Unknown in natural waters of Arizona at this time.	
Rationale: Not known to be inhabiting any natural or disturbed freshwater sites in Arizona, however, numerous private ponds and retailers who service the backyard pond market have been identified as distributors during the past three years.	
Sources of information: Personal observations by F. Northam (during tenure as the Arizona Noxious Weed Program Coordinator, Arizona Department of Agriculture, Phoenix, Arizona, 2003) and Arizona weed location records documented by F. Northam (Weed Biologist, Tempe, Arizona, 2004).	

Worksheet A. Reproductive Characteristics

Complete this worksheet to answer Question 2.4.

Reaches reproductive maturity in 2 years or less	**Yes**	**No**	**1 pt.**
Dense infestations produce >1,000 viable seed per square meter	**Yes**	**No**	**0 pt.**
Populations of this species produce seeds every year.	**Yes**	**No**	**1 pt.**
Seed production sustained for 3 or more months within a population annually	**Yes**	**No**	**1 pt.**
Seeds remain viable in soil for three or more years	**Yes**	**No**	**0 pt.**
Viable seed produced with *both* self-pollination and cross-pollination	**Yes**	**No**	**0 pt.**
Has quickly spreading vegetative structures (rhizomes, roots, etc.) that may root at nodes	**Yes**	**No**	**1 pt.**
Fragments easily and fragments can become established elsewhere	**Yes**	**No**	**2 pt.**
Resprouts readily when cut, grazed, or burned	**Yes**	**No**	**1 pt.**

Total pts: 7 Total unknowns: 2

Score : A

Note any related traits:

Worksheet B. Arizona Ecological Types

(*sensu* Brown 1994 and Brown et al. 1998)

Major Ecological Types	Minor Ecological Types	Code*
Dunes	Dunes	
Scrublands	Great Basin montane scrub	
	southwestern interior chaparral scrub	
Desertlands	Great Basin desertscrub	
	Mohave desertscrub	
	Chihuahuan desertscrub	
	Sonoran desertscrub	
Grasslands	alpine and subalpine grassland	
	plains and Great Basin shrub-grassland	
	semi-desert grassland	
Freshwater Systems	lakes, ponds, reservoirs	**U**
	rivers, streams	**D** (historical)
Non-Riparian Wetlands	Sonoran wetlands	
	southwestern interior wetlands	
	montane wetlands	
	Playas	
Riparian	Sonoran riparian	
	southwestern interior riparian	
	montane riparian	
Woodlands	Great Basin conifer woodland	
	Madrean evergreen woodland	
Forests	Rocky Mountain and Great Basin subalpine conifer forest	
	montane conifer forest	
Tundra (alpine)	tundra (alpine)	

*A means >50% of type occurrences are invaded; B means >20% to 50%; C means >5% to 20%; D means present but ≤5%; U means unknown (unable to estimate percentage of occurrences invaded).

Literature Cited

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[USGS] U.S. Geological Survey, National Wildlife Health Center. 2001. Wild Birds Implicated in Rapid Spread of West Nile Virus Wildlife Alert #01−02. Available online at: http://www.nwhc.usgs.gov/whats_new/wha/wha0102.html; accessed March 2004.

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